PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PU030282	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/US2004/033713	International filing date *(day/month/year)* 12.10.2004	Priority date *(day/month/year)* 14.10.2003
International Patent Classification (IPC) or national classification and IPC H04N7/26, H04N5/262		
Applicant THOMSON LICENSING S.A.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 8 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
17.06.2005	01.03.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840	Authorized Officer Heising, G Telephone No. +49 30 25901-407

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2004/033713

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-15	as originally filed
Claims, Numbers	
1-14	filed with telefax on 17.06.2005
Drawings, Sheets	
1/1	received on 28.01.2005 with letter of 10.12.2004

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2004/033713

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-14
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-14
Industrial applicability (IA)	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

1 Reference is made to the following documents:

D1 : CHRISTINA GOMILA: "SEI message for film grain encoding: syntax and results" JVT OF ISO IEC MPEG AND ITU-T VCEG JVT-I013 REVISION 2, 2 September 2003 (2003-09-02), pages 1-11, XP002308743 SAN DIEGO, CA, USA

D2 : WO 97/22204 A (PRZYBORSKI, GLENN, B; GIBSON, ROBERT, F; HARN, JOHN, H; HUCKE, LLOYD,) 19 June 1997 (1997-06-19)

D3: SCHLOCKERMANN M ET AL: "Film grain coding in H.264/AVC" JOINT VIDEO TEAM (JVT) OF ISO/IEC MPEG & ITU-T VCEG (ISO/IEC JTC1/SC29/WG11 AND ITU-T SG16 Q6), 2 September 2003 (2003-09-02), pages 1-8, XP002311238 SAN DIEGO, CA, USA

D4: CHRISTINA GOMILA, ALEXANDER KOBILANSKY: "SEI message for film grain encoding" JVT OF ISO IEC MPEG AND ITU-T VCEG JVT-H022, 23 May 2003 (2003-05-23), pages 1-14, XP002308742 GENEVA, SWITZERLAND

D5: US-A-5 641 596 (GRAY ET AL) 24 June 1997 (1997-06-24)

2 INDEPENDENT CLAIM 1

The present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

2.1. Document D2, which is considered to represent the most relevant state of the art to the subject matter of claim 1, discloses (the references in parentheses applying to this document):

A method for simulating film grain in an image block of M x N pixels, where N and M are integers greater than zero, comprising the steps of:
(D2: abstract, lines 4-5, and page 22, lines 9-11)
selecting a film grain block of M x N pixels from among a pool of previously

established blocks containing film grain as a function of a random number;
(D2: page 21, line 26 - page 22, line 11, and figure 9)
and blending each pixel in the selected film grain block with a corresponding pixel in the image block.
(D2: page 22, lines 21-24)

2.2. The subject-matter of independent claim 1 differs from the disclosure of D2 in that the steps

1) computing the average of the pixel values within the block of M x N pixels;
2) selecting a film grain block as a function of the average value of the image block
are missing in D2.

2.3. The problem to be solved by the present invention may therefore be regarded as:

How to adapt the simulated grain noise to the input image characteristics to improve the visual output video quality.

2.4. In view of D1 the solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

In D2 the intensity of the film grain block is selected by the "grain intensity selector 905" (D2: page 22, lines 18-20). On page 22, lines 26-28 one example of how to choose the grain intensity is given: "For example, the operator selects the grain intensity with a multiposition rotary switch of selector 905." Therefore, it is clear that other examples are possible. Looking for other solutions and being confronted with the above stated problem the question is how to select the grain intensity to solve the problem.
It is well known that film grain noise originating from video acquisition on a motion picture film is image dependent. Thus, to improve the visual quality of the output video of D2 the grain noise block should be adapted to the input image block. To solve the problem posed, D1 suggests to compute the average of the input block (D1: page 3, lines 28-36) and to scale the intensity of the grain block during generation as

a function of the (quantized) average value "s" of the input block (D1: page 4, lines 17-30). Thus, for the skilled person it is obvious to combine and he therefore would combine the feature of adapting/selecting the intensity of the grain depending on the average of the input block which is known from D1 with the method of D2 to improve the quality of the film grain.

2.5 Therefore, the features disclosed in D1 and D2 would be combined by the skilled person, without exercise of any inventive skills in order to solve the problem posed. The proposed solution in independent claim 1 thus cannot be considered inventive (Article 33(3) PCT).

3 INDEPENDENT CLAIM 4

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 4 does not involve an inventive step in the sense of Article 33(3) PCT.
Document D1 discloses (the references in parentheses applying to this document) page 4, lines 14-30:

A method for creating L blocks (page 4: lines 20 and 30 "blocks") *of M x N pixels with film grain, where L, N and M are integers greater than zero, for selection as a function of the average value of the image block and a random number, comprising the steps of:*
receiving film grain information that includes at least one parameter that specifies an attribute of the film grain to appear in each of the L blocks;
("param[c][l][j]")
creating L blocks of M x N random values, each block having its MxN random values selected from a previously established list of Gaussian random numbers;
(page 4 , lines 20-22, with Gaussian numbers "b_N", where it is clear for the person skilled in the art that these numbers can either be generated online or offline, i.e. taken form a look-up table, depending on the available computational and memory resources).
computing a Discrete Cosine Transform for each of the L blocks of the M x N random

numbers;
(page 4, lines 20-23)
filtering the M x N coefficients for each of the L blocks resulting from the Discrete Cosine Transform by at least one parameter in the received film grain information;
(page 4, lines 24-28, using grain information "param[c][l][j]")
computing an Inverse Discrete Cosine Transform of the filtered set of coefficients for each of the L blocks;
(page 4, line 29)
scaling all the pixel values for each of the L blocks as indicated by one parameter in the received film grain information;
(page 4, equation 3 with "param[c][s][0]" and "log2_scale_factor" as scaling factors)

Thus, all features of claim 4 but the following are known form D1:

storing each of the L blocks of film grain into a pool of film grain blocks for selection as a function of the average value of the image block and a random number

A person skilled in the field of film grain simulation knows that the created blocks in D1 can either be used directly for blending or can be stored in memory for later use. This again is a question of the available computational and memory resources. For example, in D2 and D3 grain blocks and in D5 grain parameters are precalculated and stored in memory for later use.

This feature is therefore merely one of two straight forward possibilities from which the skilled person would select, in accordance with circumstances, without the exercise of inventive skill, in order to solve the problem posed.

Furthermore, the functional feature of "*for selection as a function of the average value of the image block and a random number*" is also not inventive since the created blocks are suitable for being selected as a function of the average value of the image block and a random number. And also the selection depending on a) the block average is known from D1 and on b) a random number from D2.

4 INDEPENDENT CLAIMS 8 AND 11

Claims 8 and 11 are the corresponding apparatus claims to the above method claims 1 and 4. It is to be observed that each means of a apparatus is perfectly matching to one corresponding technical feature of the corresponding method claim.
The only difference is that in claim 4 the method is performed for L blocks and in the corresponding apparatus claim 11 means for "creating a block" are given. But D1 discloses the creation of a single block as well.
Thus, for the same reasons as given in sections 2 and 3 above these corresponding apparatus claims 8 and 11 do not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 8 and 11 do not involve an inventive step in the sense of Article 33(3) PCT.

5 DEPENDENT CLAIMS 2, 3, 5-7, 9, 10, 12-14

Dependent claims 2, 3, 5-7, 9, 10, 12-14 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(2) and (3) PCT), see documents D1-D5 and the corresponding passages cited in the search report.

6 CLAIMS 1-14

Claims 1-14 disclose methods and apparatus for video processing applications to improve the visual quality. Therefore, the subject-matter of these claims is considered to be industrially applicable according to Article 33 (4) PCT.

CLAIMS

1. A method for simulating film grain in an image block of M x N pixels, where N and M are integers greater than zero, comprising the steps of:

computing the average of the pixel values within the block of M x N pixels;

selecting a film grain block of M x N pixels from among a pool of previously established blocks containing film grain as a function of the average value of the image block and a random number; and

blending each pixel in the selected film grain block with a corresponding pixel in the image block.

2. The method according to claim 1 further including the step of accessing a look up table containing random numbers to obtain the random number.

3. The method according to claim 2 further comprising the step of populating the look-up table in advance of film grain simulation with random numbers generated by a random number generator.

4. A method for creating L blocks of M x N pixels with film grain, where L, N and M are integers greater than zero, for selection as a function of the average value of the image block and a random number, comprising the steps of:

receiving film grain information that includes at least one parameter that specifies an attribute of the film grain to appear in each of the L blocks;

creating L blocks of M x N random values, each block having its M x N random values selected from a previously established list of Gaussian random numbers;

computing a Discrete Cosine Transform [of the] for each of the L blocks of M x N random numbers;

filtering the M x N coefficients for each of the L blocks resulting from the Discrete Cosine Transform by at least one parameter in the received film grain information;

computing an Inverse Discrete Cosine Transform of the filtered set of coefficients for each of the L blocks;

scaling all the pixel values for each of the L blocks as indicated by one parameter in the received film grain information; and

storing each of the L blocks of film grain into a pool of film grain blocks for selection as a function of the average value of the image block and a random number.

5. The method according to claim 4 further comprising the step of performing an integer approximation of a Discrete Cosine Transform (DCT) and the Inverse Discrete Cosine Transform (IDCT) to reduce complexity.

6. The method according to claim 4 further comprising the step of scaling top and bottom edges of each of the L film grain blocks to hide block edges.

7. The method according to claim 4 wherein the step of receiving the film grain information further comprises the step of decoding a Supplemental Enhancement Information message containing the at least one parameter.

8. Apparatus for simulating film grain in an image block of M x N pixels, where N and M are integers greater than zero, comprising:

means for computing the average of the pixel values within the block of M x N pixels;

means for selecting a film grain block of M x N pixels from among a pool of previously established blocks containing film grain as a function of the average value of the image block and a random number; and

means for blending each pixel in the selected film grain block with a corresponding pixel in the image block.

9. The apparatus according to claim 8 further a look up table containing random numbers to obtain the random number.

10. The method according to claim 9 where the look-up table is populated in advance of film grain simulation with random numbers generated by a random number generator.

11. An apparatus for creating a block of M x N pixels with film grain, where N and M are integers greater than zero for selection as a function of the average value of the image block and a random number, comprising:

means for receiving film grain information that includes at least one parameter that specifies an attribute of the film grain to appear in the block;

means for creating a block of M x N random values selected from a previously established list of Gaussian random numbers;

means for computing an Discrete Cosine Transform of the M x N block of random numbers;

means for filtering the M x N coefficients resulting from the Discrete Cosine Transform by at least one parameter in the received film grain information;

means for computing an Inverse Discrete Cosine Transform of the filtered set of coefficients;

means for scaling all the pixel values in the block as indicated by one parameter in the received film grain information; and

means for storing the created block of film grain into a pool of film grain blocks for selection as a function of the average value of the image block and a random number.

12. The apparatus according to claim 11 further comprising means for performing an integer approximation of a Discrete Cosine Transform (DCT) and the Inverse Discrete Cosine Transform (IDCT) to reduce complexity.

13. The apparatus according to claim 11 further comprising the means for scaling top and bottom edges of the created film grain block to hide block edges.

14. The apparatus according to claim 11 wherein means for receiving the film grain information further comprises means for decoding a Supplemental Enhancement Information message containing the at least one parameter.